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How to CALCULATE

size-class distribution for all-age forests

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One of the key steps in managing an all-age stand is to develop a balanced size-class distribution that will assure maximum sustained yield. Size class distribution in an ideal all-age forest follows a simple geometric progression. The ratio between the number of trees in succeeding size classes is called "q". The number of trees in a size class multiplied by q results in the number in the next smaller size class.

The method of calculating size-class distribution illustrated here takes desired basal area and maximum size of tree to be grown and quickly determines the number of trees in the maximum size class, using a "K" factor taken from the accompanying table. (This factor is the sum of q raised to a power equal to one minus the ranking of each size class in the progression multiplied by the basal area of the size class.)

PROCEDURE

Step 1: Choose a maximum diameter tree to be grown and a total residual stand basal area.

Step 2: Decide on a q factor (see "Application and Common Sense").

Step 3: Detemine K factor from table below.

Step 4: Divide the K factor into the total stand basal area to get number of trees in the largest size class (N).

Step 5: Multiply N by the applicable q factor to find the next smaller size class. Multiply this

K coefficient for a given maximum diameter

Maximum diameter *(inches)*	q factor						
	1.1	1.2	1.3	1.4	1.5	1.6	1.7
24	18.5	24.8	34.3	48.1	68.0	97.3	139.3
22	14.0	18.2	24.0	32.1	43.4	58.9	80.1
20	10.3	13.0	16.4	21.1	27.2	35.2	45.6
18	7.4	9.0	11.0	13.5	16.7	20.6	25.5

number by q to find the next smaller size class and so on to the smallest class.

APPLICATION AND COMMON SENSE

A balanced size-class distribution is intended to provide: (1) good conditions for growth and quality development, (2) sustained yield, and (3) maximum yield where harvest equals growth.

There are two principle ways of developing a balanced, all-age structure. One is to determine the number of trees needed in each size class and to cut unneeded trees in each class at each cutting cycle. However, in poorly or unevenly stocked stands, this procedure may reduce total stocking below that consistent with good growth and quality development. Eventually such stands will attain a balanced condition but at the expense of growth and yield during the period of regulation.

The other way is to set a residual basal area level through several cutting cycles. This tends to optimize growth but may reduce yield to the extent that the stand is not balanced. In essence, foregone yields are invested in building up the size classes. This method prevents over cutting or under cutting when at least two size classes are recognized (poles and saw logs).

The initial treatment of unregulated tolerant northern hardwood stands managed for saw logs generally requires that only two size classes be recognized (poles and saw logs) because normally the greatest need is to upgrade tree quality and reduce cull. Concentrating the cut in the most over-stocked portion of the stand allows the remaining trees to grow faster and fill in gaps in the size-class distribution. At this stage, it makes no sense to leave poorly formed or defective trees to more rapidly fill up gaps. It also does not make sense to cut exceptionally well formed trees in the smaller size classes to exactly meet the numerical goal.

On the other hand, it makes some sense to adhere strictly to total stocking level goals, because cutting all trees with some defect may create poor growing conditions for those that are left and may reduce stocking below that needed to maintain growth.

Although it is not necessary to recognize many size classes at the outset of management, it will be useful to set maximum tree size goals early so that fairly well developed stands are not over or under cut, thus delaying the development of a balanced structure and optimum yields.

After the period of regulation it is logical to cut to prescribed levels in each size class. Although 2-inch classes are used here, it is more practical to use 4- or 5-inch classes in field work to speed marking and provide some flexibility to the marker. For example, 5-inch classes break the size classes into poles, small, medium, and large saw logs, which are easily recognizable in the field without measurement.

Guides for choosing a q factor are subjective at present. You may easily calculate several size class distributions and, after considering other pertinent information, decide on the one best suited to meeting your goals. In the Northeast q values generally fall between 0.5 and 1.7. In Lake States northern hardwoods the q value 1.3 seems to develop adequate tree quality and growth when maximum d.b.h. does not exceed 24 inches and residual stocking is about 70 square feet per acre in trees 10 inches and larger and when the object is to maximize timber growth. In general, low q's (1.1) will describe stands with many large trees while large q's (1.5) describe stands with many small trees. There may be some financial advantage to some owners to large q's because the average per acre value may be low and profit ratios high. Conversely, owners wishing to grow large trees may find lower q values advantageous.

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